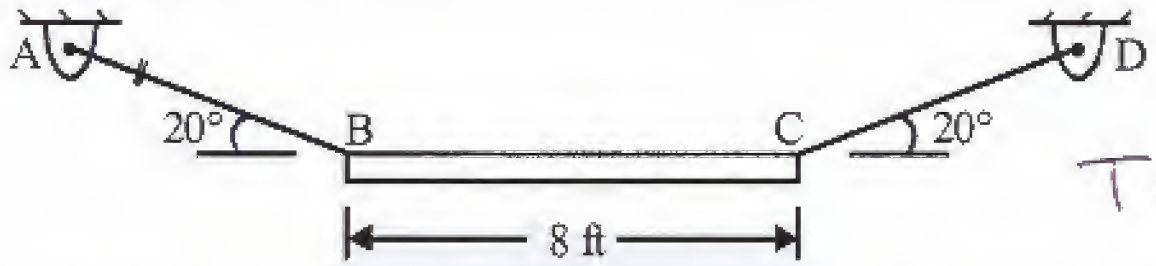
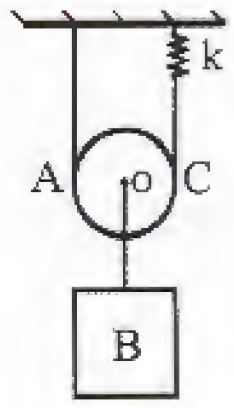
1. A uniform beam BC has a weight of 120 lb. It is originally at rest while being supported at B and C by cables.



T = 30.4 lb

If cable AB fails, determine the tension in cable CD just after the failure. Treat the beam as a slender rod.

2. A pulley has a radius of 500 mm, a mass of 60 kg and a radius of gyration of 350 mm about its center of gravity O. Hanging from point O is a block B of 120 kg. The pulley is suspended by a cable which is wrapped around it and which is connected to a spring of stiffness k = 2000 N/m. If the system is released from rest with the spring initially stretched 50 mm, determine the distance point O travels before it reaches a velocity of 0.5 m/s. Assume that point O moves vertically, and there is no slipping between the cable and the pulley.

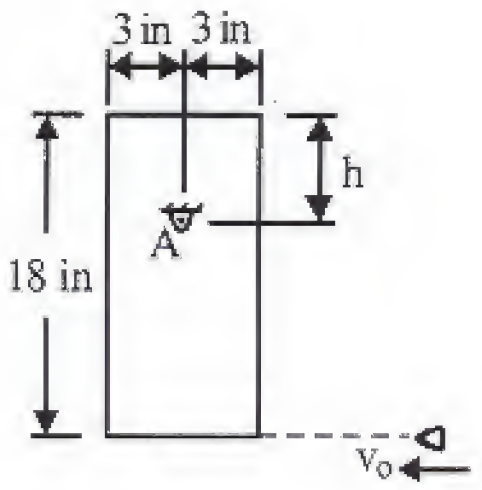


$d_o = 17.5\,mm$

3. A 0.12-lb bullet is fired with a horizontal velocity of v_o = 900 ft/s into an 8-lb plate. The plate is originally at rest and is pinned at a point A. The bullet becomes embedded at a point very close to the middle of the bottom of the plate during the impact. Determine:

(a) the required distance h if the impulsive reaction at pin A is to be zero; and

(b) the corresponding angular velocity of the plate just after impact.



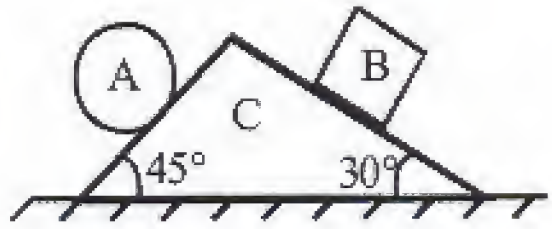
$h = 0.472$ ft

$\vec{\omega}_2 = -46.0\,\hat{k}$ rad/s

4. A slender rod AB of length L and weight W is pinned at end A and is released from rest in the vertical position shown so that it swings counterclockwise. It is observed that the rod rebounds to a horizontal position (and no further) after striking the vertical surface. Determine the coefficient of restitution between the knob at end B and the surface. Treat AB as a straight slender rod of length L when determining its center of mass and moment of inertia.

$e = 0.707$

5. A uniform sphere, A, and a uniform block, B, sit on wedge C which lies on a horizontal surface. The sphere has a mass of 5 kg and a radius of 20 mm. The block B has a mass of 8 kg and the wedge C has a mass of 10 kg. The sphere, block and wedge are all held at rest and then released simultaneously. The sphere rolls without slipping and the block slides without friction along the wedge. The coefficients of friction between the wedge and the horizontal surface are $\mu_s = 0.15$ and $\mu_k = 0.1$. Determine the initial acceleration of the wedge and the initial angular acceleration of the sphere just after release of the system.



$\vec{a}_c = 0$

$\vec{\alpha} = 248\hat{k}\ \frac{rad}{s^2}$